

COURSE SYLLABUS

1. Program information

1.1. Institution	Petroleum-Gas University of Ploiești
1.2. Faculty	Petroleum Refining and Petrochemistry
1.3. Department	Petroleum Processing Engineering and Environmental Protection
1.4. Field of study	Chemical Engineering
1.5. Study cycle	Master degree
1.6. Study program	Chemical Engineering for Refineries and Petrochemistry

2. Course information

2.1. Course title	Dynamic simulation and advanced control systems for chemical processes		
2.2. Course coordinator	Lect. dr. eng. Popescu Marian		
2.3. Laboratory coordinator	Lect. dr. eng. Popescu Marian		
2.4. Project coordinator			
2.5. Year of study	II		
2.6. Semester *	3		
2.7. Evaluation type	Exam		
2.8. Course type - formative category **	S2	2.8. Type of subject matter ***	C

* the semester number is in accordance with the curriculum;

** fundamental = F0; domain = D1; speciality = S2; complementary = C3, thoroughgoing study = T4, synthesis = Sy 5

*** compulsory = C; optional = O; elective = E

3. Total estimated time (teaching hours per semester)

3.1. Number of hours per week	4	of which: 3.2. course	2	3.3. Laboratory	2	3.4. Project	
3.5. Total hours from curriculum	56	of which: 3.6. course	28	3.7. Laboratory	28	3.8. Project	
3.9. Time distribution							hours
Study of textbook, course support, bibliography and notes							30
Further reading in the library, on online platforms and fieldwork							20
Preparing seminars / laboratories, homework, portfolios and essays							40
Tutoring							-
Examinations							4
Other activities							
3.10. Total hours of individual study	94						
3.11. Total hours per semester	150						
3.12. Number of credits	6						

4. Prerequisites (where applicable)

4.1. of curriculum	➤ Basic Chemical Processes Control
4.2. of skills	➤ Physical, chemical, mathematics knowledge

5. Requirements (where applicable)

5.1. of course	➤ Class room with table, multimedia equipment
5.2. of laboratory	➤ Laboratory room, table, industrial control systems, chemical process simulator, distributed control system

6. Specific competences

Professional competences	<ul style="list-style-type: none"> ➤ Designs equipment and equipment for utilities: design of appliances, processes and installations with the application of knowledge in the field of chemical engineering. ➤ Real time control of processes and installations from chemical engineering
Cross-cur competences	<ul style="list-style-type: none"> ➤ Ability to provide information and documentation in its field of activity, but also in related fields, in a language of international circulation. ➤ Efficient and effective performance of individual professional activities, under conditions of autonomy and professional independence. ➤ Knowledge, at an advanced level, of software specific to chemical engineering and computer and internet use.

7. Course objectives (based on the competence grid)

7.1. General objective	<ul style="list-style-type: none"> ➤ Dynamic modelling and simulation of chemical processes ➤ Advanced control of chemical processes
7.2. Specific objectives	<ul style="list-style-type: none"> ➤ Numerical solving of differential equations ➤ Dynamic modelling of simple chemical processes ➤ Dynamic modelling of automatic control systems ➤ Fundamentals of automatic control systems for chemical processes ➤ Structures of automatic control systems for chemical processes ➤ Design, operation and exploitation of automatic control systems ➤ Distributed control system configuration

8. Contents

8.1. Course	Time	Teaching methods	Comments
Numerical solving of ordinary differential equations	4	Interactive, based on multimedia and student-centered techniques	
Dynamics of some simple chemical processes	6		
Dynamic simulation using transfer functions	4		
Concepts of hierarchical and distributed systems	4		
Numerical control equipment	4		
Distributed control systems	6		
Bibliography			
<ol style="list-style-type: none">1. Basu S., Chapter 1 - General discussions on control systems, Editor(s): Basu S., Plant Intelligent Automation and Digital Transformation, Academic Press, Vol. 1, 2023, Pages 1-56.2. Gillis A.S., Distributed Control System (DCS), TechTarget, 2023.3. Kluever C. - Dynamic Systems: Modeling, Simulation and Control, Wiley, 2019.4. Mehta B.R., Reddy Y.J., Distributed control system, In: Industrial Process Automation Systems (pp.75-133), Elsevier, 2015.5. Patrascioiu C., Popescu M., <i>Dinamica sistemelor chimice</i>, Editura MatrixRom, Bucuresti, 2015.6. Patrascioiu C., Popescu M., <i>Sisteme de conducere a proceselor chimice – Aplicatii</i>, Editura MatrixRom, Bucuresti, 2013.7. Paraschiv N., Popescu M., Pătrășcioiu C. - Advanced real time control of an industrial mass transfer process, Proceedings of the International Conference on Computational Heat and Mass Transfer (ICCHMT09), Guangzhou, China, 2009, pp 602-607.8. Paraschiv N., Achiziția și prelucrarea datelor, Editura UPG Ploiești, 2013.9. Paraschiv N., Popescu M., Sisteme distribuite de supervizare și control, Editura UPG Ploiești, 2014.10. Popescu M., Distillation Column Hierarchical Control, REV. CHIM. (Bucharest), 69, No. 9, p 2595-2600, 2018.			

11. Raczynski S., Models for Research and Understanding Exploring Dynamic Systems, Unconventional Approaches, and Applications, Springer Nature Switzerland AG, 2022.			
8.2. Laboratory	Time	Teaching methods	Comments
Numerical solving of ordinary differential equations using MATLAB	4	Student-centered interactive teaching methods, in the sense of monitoring and verifying the student's understanding of the approached issues	
Modelling and simulation of some simple chemical processes	4		
Transfer functions. System simulation using SIMULINK	2		
Basic knowledge of DeltaV distributed system	2		
Analog and digital inputs and outputs configuration	8		
FOUNDATION fieldbus system configuration	4		
Operating interfaces configuration	4		
Bibliography			
1. Emerson Process Management – DeltaV™ M-series Traditional I/O, 2017.			
2. Fisher-Rosemount Systems, Inc. – DeltaV Books Online, 2013.			
3. Paraschiv N., Popescu M. – <i>Sisteme distribuite de supervizare și control</i> , Ed. Universității Petrol-Gaze din Ploiești, 2014.			
4. Patrascioiu C., Popescu M., <i>Dinamica sistemelor chimice</i> , Editura MatrixRom, Bucuresti, 2015.			
5. Patrascioiu C., Popescu M., <i>Sisteme de conducere a proceselor chimice – Aplicatii</i> , Editura MatrixRom, Bucuresti, 2013.			
6. Popescu M., <i>Sisteme distribuite de supervizare și control – Îndrumar de laborator</i> , Editura UPG Ploiești, 2018.			

9. Correlation of the course contents with the demands of the epistemic community representatives, professional associations and representative employers in the field of the program

The discipline is monitored by representatives of refineries and design firms in the chemical field

10. Evaluation

Activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Percentage of final grade
10.4. Course	Analytical solving and numerical solving algorithms of ordinary differential equations	Written test	20%
	Knowledge of dynamic models of simple systems	Written test	20%
	Understanding fundamentals of distributed control systems	Written test	20%
10.5. Laboratory	Numerical solving of ordinary differential equations	Homework	20%

	Modelling and numerical simulation of simple systems	Homework	10%
	Understanding and implementation of distributed control systems configuration	Test	10%
10.6. Project			
10.6. Minimum performance standard			
<ul style="list-style-type: none"> ➤ Analytical solving of an ordinary differential equation and graphical representation of the solution ➤ An example of a static characteristic of a process ➤ Basic knowledge of DeltaV distributed control system 			

Signature/date
05.02.2025

Course coordinator



Laboratory coordinator



Project coordinator

Date of approval in the
department
20.03.2025

Head of department
Assoc. prof. PhD. Eng.
Neagu Mihaela



Dean
Assist. prof. PhD. Eng. Duşescu-Vasile
Cristina

